PHYS355
Introduction to Biological Physics

Spring 2019
BRK 103

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Class meetings

The class will meet Tuesday and Thursday from 1:00pm to 2:15pm in 103 BRK (Brockman Hall for Physics).

Reference Texts

- Thomas Andrew Waigh *The Physics of Living Processes*, John Wiley & Sons (2014).
- Philip Nelson, *Biological Physics*, W. H. Freeman and Company (2014).
- M. Daune, *Molecular Biophysics: Structures and Dynamics*, Oxford University Press (1999).
- L. Stryer, *Biochemistry*, 5th ed., W. H. Freeman, New York (2003).
- Cantor and Schimmel, *Biophysical Chemistry, I, II, III*, W. H. Freeman, New York (1980).

Course Description

This course will cover topics in frontier of biological physics.

Important Dates

7 January 2019	First day of classes
7–8 February 2019	Spring Recess, no classes
9–17 March April 2019	Spring Break, no classes
19 April 2019	Last day of classes

Honor Code
The Rice Honor Code applies.

Homework Policy
Homework assignments will be given every week on Thursday. Homework will be due the following Thursday in the beginning of class. Late homework will not be accepted. You are allowed to collaborate with fellow students on your homework. You may not consult answer keys (from previous years, *etc.*). The homework you turn in must represent your own understanding.

Midterm Report
The midterm report is a short report on the subject, of the paper(s) you choose to present in class. The selected topic/paper must be related to biological physics. Detailed instructions about the midterm report will be given later in the semester.

Final Presentation
Each person will give a 30–45 (TBD) minute presentation in class. The presentation topic should be chosen from a list given in class.

Credit

Homework	40 %
Midterm report	20 %
Final presentation	40 %

Tentative Outline of the Course
DNA
RNA
Proteins
Cells
Bacteria
Eukaryotic systems
Virus
Brownian Motion
Polymer Physics Models of Biomolecules
Single molecule techniques
Cancer and other diseases

Course Objectives: Students should learn

- The fundamentals of nucleic acids and proteins [Course outcomes 1–2]
- To apply methods for solving the protein folding problems [Course outcomes 2–3]
- To apply methods for quantifying reactions involving bacterial cells and viruses at the molecular and cellular levels [Course outcomes 4–5]

- To apply governing equations for Brownian motion and random walks [Course outcomes 6]
- To apply governing equations to calculate persistence length[Course outcomes 7]
- The technique and information obtained from single molecule biophysics experiments [Course outcomes 8]
- Cancer physics [Course outcomes 9]
- Understanding and communicating modern biological physics topics [Course outcomes 10]

Course Outcomes: Students completing the course should be able to

- Describe the structure and function of nucleic acids
- Describe and illustrate the structure and function of proteins
- Calculate protein folding thermodynamics and kinetics
- Estimate molecular quantities and reactions in bacterial cells
- Describe virus building blocks, function, and life cycle
- Calculate Brownian motion and random walks
- Calculate persistence length in polymer physics models
- Describe the technique and information obtained from single molecule biophysics experiments
- Describe cancer physics
- Perform literature search for modern biological physics topics and communicate the findings to peers

If you have a documented disability that will impact your work in this class, please contact me to discuss your needs during the first two weeks of class. Additionally, you will need to register with the Disability Support Services Office in the Ley Student Center.